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Author(s)	EHARA, Shôzô
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# Phytoseiid Mites from Hokkaido (Acarina: Mesostigmata)<sup>1)</sup>

By

Shôzô Ehara

Zoological Institute, Hokkaido University  
(With 71 Text-figures)

Seven mite species belonging to the family Phytoseiidae were recorded from Hokkaido prior to this study. In the present paper descriptions and records are given of the following twelve phytoseiid species, ten of which are new to science:

1. *Typhlodromus* (*Anthoseius*) *borealis* n. sp.<sup>2)</sup> (p. 213)
2. *Amblyseius* (*Amblyseius*) *haimatus* n. sp. (p. 214)
3. *Amblyseius* (*Amblyseius*) *paraki* n. sp. (p. 216)
4. *Amblyseius* (*Amblyseius*) *ainu* n. sp. (p. 218)
5. *Amblyseius* (*Amblyseius*) *morii* n. sp. (p. 219)
6. *Amblyseius* (*Amblyseius*) *tsugawai* Ehara (p. 221)
7. *Amblyseius* (*Amblyseius*) *firmus* n. sp. (p. 222)
8. *Amblyseius* (*Amblyseius*) *ezoensis* n. sp. (p. 223)
9. *Amblyseius* (*Kampimodromus*) *maritimus* n. sp. (p. 224)
10. *Phytoseius* (*Phytoseius*) *nipponicus* Ehara (p. 227)
11. *Phytoseius* (*Phytoseius*) *kishii* n. sp. (p. 228)
12. *Phytoseius* (*Phytoseius*) *campestris* n. sp. (p. 229)

A key to the species of phytoseiids found in Hokkaido is added in final pages of this paper. The type specimens of the new species described here are retained in the Zoological Institute, Faculty of Science, Hokkaido University.

The major part of the materials on which this paper is based were collected by staff and students of the Department of Applied Zoology, Faculty of Agriculture, Hokkaido

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1) Contribution No. 785 from the Zoological Institute, Faculty of Science, Hokkaido University, Sapporo, Japan.

2) Since *Neoseiulus* Hughes, 1948, is a synonym of *Amblyseius* Berlese, 1915, the names of the four Japanese species so far referred to the subgenus *Neoseiulus* are changed (cf. Ehara, 1967, p. 69):

*Typhlodromus* (*Anthoseius*) *bambusae* Ehara  
*Typhlodromus* (*Anthoseius*) *insularis* Ehara  
*Typhlodromus* (*Anthoseius*) *vulgaris* Ehara  
*Typhlodromus* (*Anthoseius*) *yasumatsui* Ehara

*Jour. Fac. Sci. Hokkaido Univ. Ser. VI, Zool. 16, 1967.*

University, in Sapporo and its vicinity, Hidaka, and Sarobetsu. Other part of the materials were taken by members of the Zoological Institute, Faculty of Science, Hokkaido University, in Prov. Abashiri and at Mt. Muine. The writer is indebted to Dr. H. Mori and Mr. N. Kishi of the Department of Applied Zoology, and to Messrs. H. Fukuda, T. Matsumura, H. Tamura, and K. Yamauchi of the Zoological Institute, for their kindness in placing these materials at the writer's disposal. The writer is also very grateful to Dr. A.M. Hughes, Royal Free Hospital School of Medicine, London, for the loan of specimens of *Amblyseius (A.) barkeri*, to Dr. W. Karg, Biologische Zentralanstalt Berlin, Kleinmachnow, for the loan of specimens of *A. (A.) reticulatus*, and to Dr. M. H. Muma, University of Florida, Lake Alfred, for the loan of a specimen of *A. (A.) barkeri*. Finally, his thanks are due to Prof. M. Yamada and Dr. Sh. F. Sakagami, Zoological Institute, Hokkaido University, who kindly made profitable suggestions.

1. *Typhlodromus (Anthoseius) borealis* n. sp.

(Jap. name: Kitami-kaburidani)

(Figs. 1-7)

*Female.* Dorsal shield strongly sculptured; six pairs of dorsocentral setae; a small but distinct pore between setae  $D_2$  and  $L_4$ . Setae on dorsal shield:  $L_{10}$  stout, serrate, weakly capitate; remaining setae much smaller, practically nude. Setae  $S_1$  and  $S_2$  on interscutal membrane. Peritreme extending forward to seta  $D_1$ . Sternal shield with two pairs of setae; third pair of sternal setae set on weakly sclerotized platelets; metasternal platelets as illustrated. Ventrianal shield approximately pentagonal, longer than wide, wider than genital shield, with four pairs of preanal setae; a pair of minute pores in a transverse line with the posteriormost preanal pair. Four pairs of setae on membrane surrounding ventrianal shield. Two pairs of slender metapodal platelets, the anterior pair very slender. Spermatheca as figured. Leg IV with three capitate macrosetae, those on genu and tibia similar in length to other setae on these segments. Measurements in microns: idiosoma length 430, idiosoma width 280; lengths of setae:  $L_1$  18,  $L_2$  16,  $L_3$  19,  $L_4$  18,  $L_5$  21,  $L_6$  23,  $L_7$  23,  $L_8$  26,  $L_9$  24,  $L_{10}$  38,  $M_1$  17,  $M_2$  26,  $D_1$  19,  $D_2$  15,  $D_3$  16,  $D_4$  18,  $D_5$  20,  $D_6$  11,  $S_1$  19,  $S_2$  18,  $VL_1$  31, macrosetae of leg IV: genu 19, tibia 21, basitarsus 30.

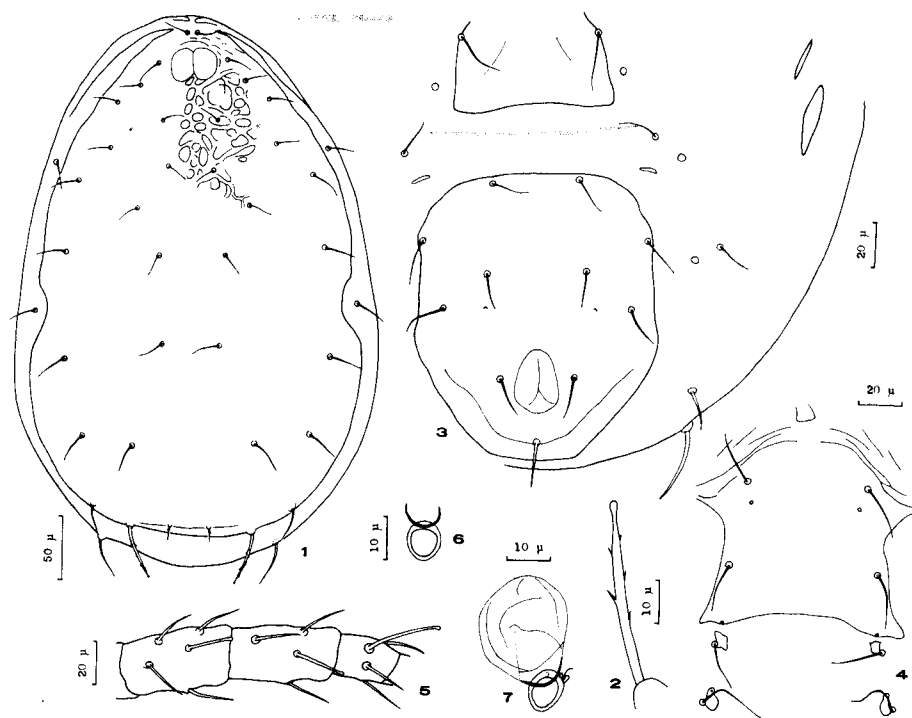
*Male.* Not known.

*Type.* Holotype: ♀, Hamakoshimizu, Prov. Abashiri, 21-VI-1966 (T. Matsumura leg.), on gall of *Rosa rugosa* Thunb., produced by a cynipid wasp *Liebelia (Nipporhodites) fukudae* Shinji.<sup>1)</sup>

*Remarks.* *Typhlodromus (Anthoseius) borealis* n. sp. closely resembles *T. (A.) barkeri* (Garman, 1948), but differs from it in the spermatheca and chaetotaxy of leg IV. Genu IV, tibia IV, and basitarsus IV each has one capitate macroseta and pointed setae in *borealis*, while each of them has capitate, subcapitate and pointed setae in addition to one capitate macroseta in *barkeri*. (The writer has examined a female specimen of *barkeri* borrowed from Dr. M. H. Muma.) This new species is

1) Identified by Dr. Sh. F. Sakagami.

also similar to *T. (A.) recki* Wainstein, 1958, and *T. (A.) nodosus* De Leon, 1962, but is distinguished from them by the shape of the spermatheca.



Figs. 1-7. *Typhlodromus (Anthoseius) borealis* n. sp. 1, dorsum of idiosoma (♀). 2, seta  $L_{10}$  (♀). 3, posterior ventral surface (♀). 4, sternal shield (♀). 5, genu, tibia and basitarsus of leg IV (♀). 6, 7, spermatheca.

## 2. *Amblyseius (Amblyseius) haimatus* n. sp.

(Jap. name: Miyama-kaburidani)

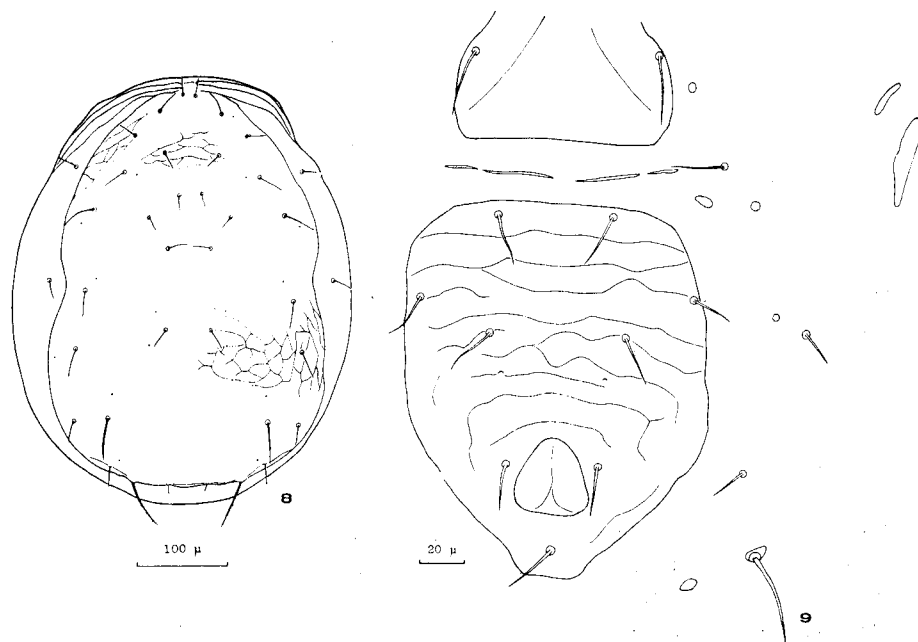
(Figs. 8-12)

**Female.** Body heavily sclerotized. Dorsal shield reticulate, with at least eight pairs of pores; six pairs of dorsocentral setae. Setae on dorsal shield:  $L_9$  and  $M_2$  stout, very weakly serrate;  $M_2$  longer than distance between its base and that of  $L_7$ , reaching a pore near  $L_8$ ; remaining setae small to minute,  $L_7$  shorter than distance its base to that of  $M_2$ . Seta  $S_1$  on interscutal membrane or on dorsal shield, seta  $S_2$  on interscutal membrane. Peritreme extending forward to seta  $D_1$ . Sternal shield with three pairs of setae; metasternal platelets as figured. Ventrianal shield longer than wide, wider than genital shield, with three pairs of preanal setae; a pair

of pores between and behind the posterior pair of preanals. Four pairs of setae on membrane surrounding ventrianal shield. Two pairs of slender metapodal platelets, the posterior pair very long. Spermatheca as illustrated. Leg IV with three pointed macrosetae. Measurements in microns: idiosoma length 460, idiosoma width 350; lengths of setae:  $L_1$  27,  $L_2$  20,  $L_3$  27,  $L_4$  35,  $L_5$  29,  $L_6$  30,  $L_7$  25,  $L_8$  23,  $L_9$  52,  $M_1$  14,  $M_2$  42,  $D_1$  22,  $D_2$  19,  $D_3$  16,  $D_4$  21,  $D_5$  24,  $D_6$  10,  $S_1$  21,  $S_2$  21,  $VL_1$  35, macrosetae of leg IV: genu 35, tibia 39, basitarsus 53.

*Male.* Not known.

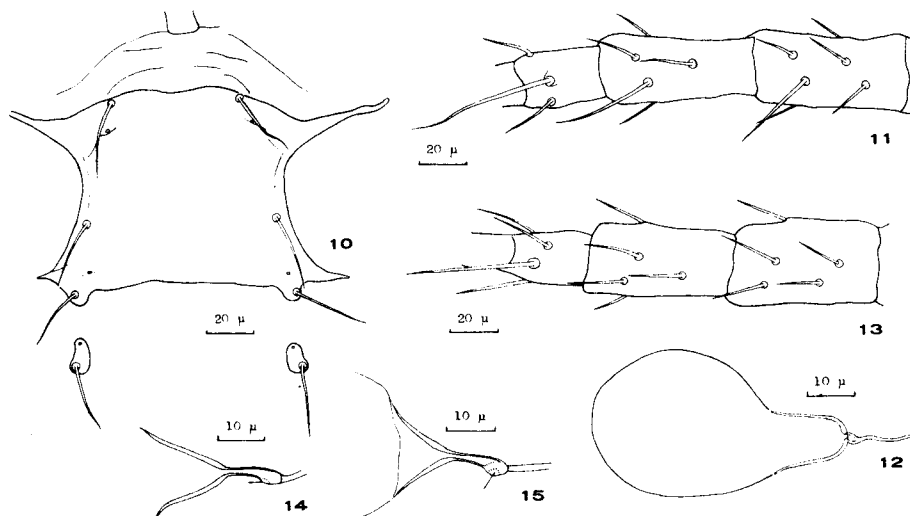
*Types.* Holotype: ♀, Mt. Muine, 28-VI-1966 (H. Fukuda leg.), on *Pinus pumila* Rgl. Paratypes: 3 ♀♀, data same as for holotype.



Figs. 8-9. *Amblyseius (Amblyseius) haimatus* n. sp. 8, dorsum of idiosoma (♀). 9, posterior ventral surface (♀).

*Remarks.* This new species closely resembles *Amblyseius (A.) reticulatus* (Oudemans, 1930b) and *A. (A.) barkeri* (Hughes, 1948) in dorsal chaetotaxy, but it differs from them in the number of the macrosetae of leg IV and in the shape of the spermatheca. The writer has examined a female and a male German specimens of *reticulatus* borrowed from Dr. W. Karg, and a female and a male English specimens of *barkeri* borrowed from Dr. A. M. Hughes. Illustrations of leg IV and spermatheca of *reticulatus* are shown in Figs. 13-15 (See also Fig. 33 in Karg, 1962). *A. barkeri*

appears to have no macrosetae on genu IV and tibia IV, and its spermatheca is very slender.



Figs. 10–12. *Amblyseius (Amblyseius) hatimatus* n. sp. 10, sternal shield (♀). 11, genu, tibia and basitarsus of leg IV (♀). 12, spermatheca. Figs. 13–15. *Amblyseius (Amblyseius) reticulatus* (Oudemans). 13, genu, tibia and basitarsus of leg IV (♀). 14, 15, spermatheca.

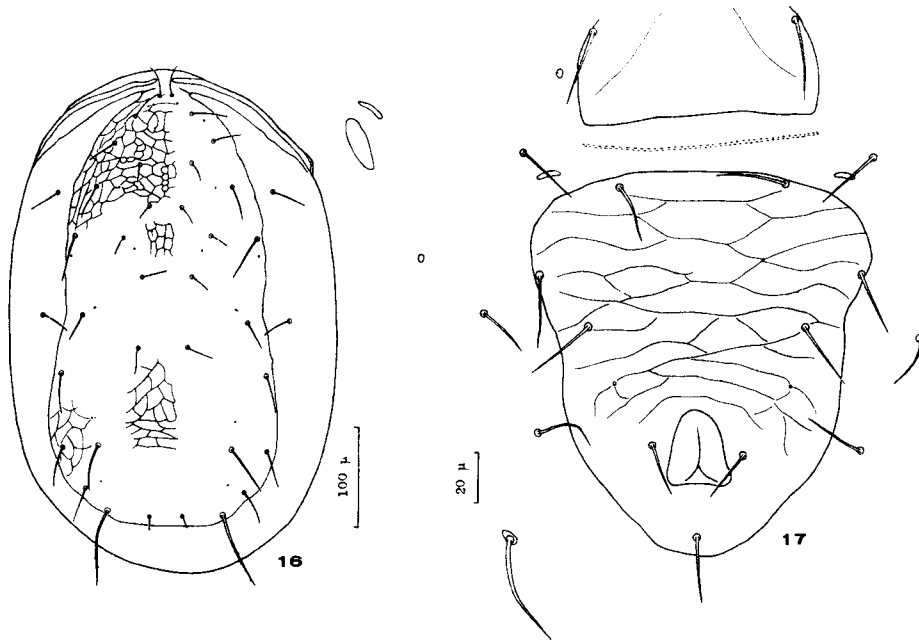
### 3. *Amblyseius (Amblyseius) paraki* n. sp.<sup>1)</sup>

(Jap. name: Paraki-kaburidani)

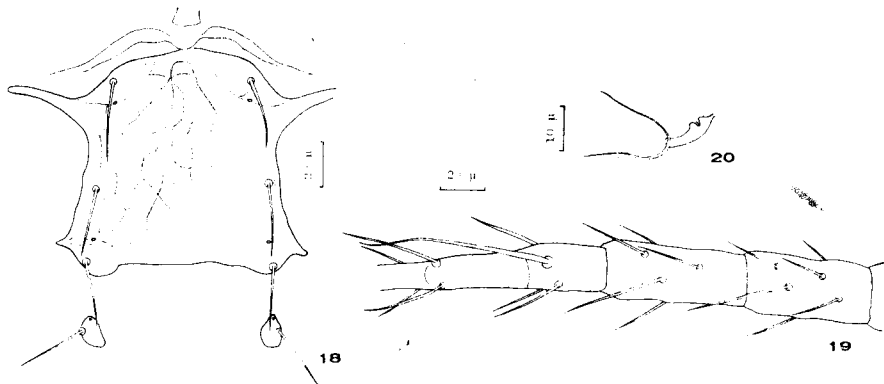
(Figs. 16–20)

*Female.* Dorsal shield reticulate, with at least eight pairs of pores; six pairs of dorsocentral setae. Setae on dorsal shield:  $L_4$  and  $M_2$  stout, smooth;  $L_9$  the stoutest, very sparsely barbed; other setae smaller,  $L_7$  longer than distance between its base and that of  $M_2$ . Setae  $S_1$  and  $S_2$  on interscutal membrane. Peritreme extending forward to seta  $D_1$ . Sternal shield with three pairs of setae; metasternal platelets oval. Ventrianal shield longer than wide, wider than genital shield, with three pairs of preanal setae; a pair of very minute pores between and behind the third pair of preanals. Four pairs of setae on membrane surrounding ventrianal shield. Two pairs of slender metapodal platelets, the posterior pair broad. Spermatheca as figured. Fixed digit of chelicera with four teeth distally. Leg IV with three pointed macrosetae. Measurements in microns: idiosoma length 470, idiosoma width 310; lengths of setae:  $L_1$  33,  $L_2$  26,  $L_3$  31,  $L_4$  42,  $L_5$  28,  $L_6$  37,  $L_7$  36,  $L_8$  33,  $L_9$  68,  $M_1$  20,  $M_2$  45,  $D_1$  26,  $D_2$  18,  $D_3$  17,  $D_4$  22,  $D_5$  26,  $D_6$  12,  $S_1$  29,

1) "Paraki" is an Ainu noun meaning mite.



Figs. 16–17. *Amblyseius (Amblyseius) paraki* n. s.p. 16, dorsum of idiosoma (♀). 17, posterior ventral surface (♀).



Figs. 18–20. *Amblyseius (Amblyseius) paraki* n. sp. 18, sternal shield (♀). 19, genu, tibia and tarsus of leg IV (♀). 20, spermatheca.

S<sub>2</sub> 27, VL<sub>1</sub> 39, macrosetae of leg IV: genu 42, tibia 39, basitarsus 74.

*Male.* Not known.

*Type.* Holotype: ♀, Sapporo, 6-VI-1966 (N. Kishi leg.), on apple.

*Remarks.* *Amblyseius* (*A.*) *paraki* n. sp. is similar to *A.* (*A.*) *cucumeris* (Oudemans, 1930b), but is different from the latter in having the peritremes much longer (Schuster and González, 1963). Further, this new mite is somewhat similar to *A.* (*A.*) *zwölferi* (Dosse, 1957), but is distinctive from it in the relative lengths of the dorsal setae.

#### 4. *Amblyseius* (*Amblyseius*) *ainu* n. sp.

(Jap. name: Ainu-kaburidani)

(Figs. 21-27)

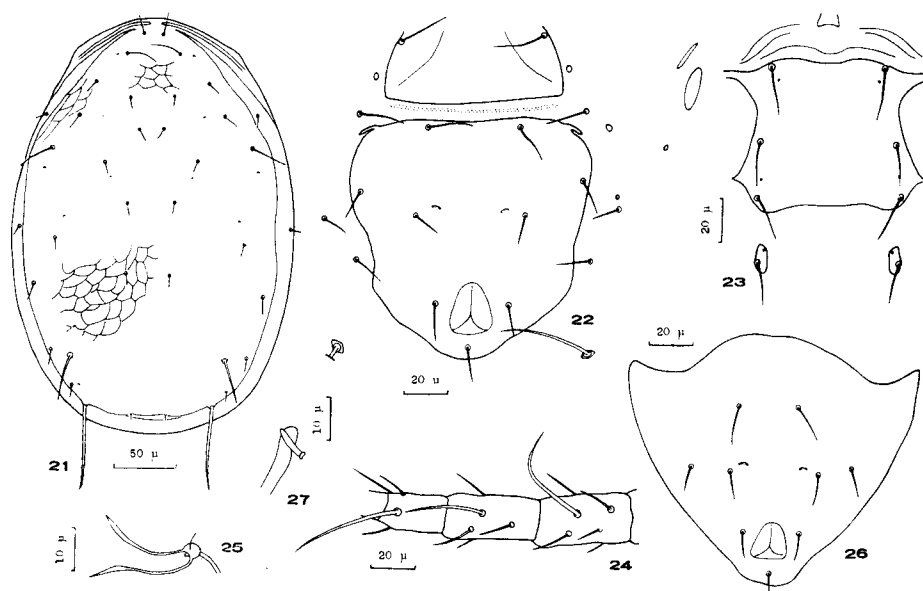
*Female.* Dorsal shield reticulate, with at least seven pairs of pores; six pairs of dorsocentral setae. Setae on dorsal shield: L<sub>9</sub> stout, serrate, much shorter than distance between bases of L<sub>9</sub>; M<sub>2</sub> stout, practically nude, approximately one half as long as L<sub>9</sub>; L<sub>4</sub> nude, about twice as long as L<sub>3</sub> and L<sub>6</sub>; L<sub>1</sub> more or less longer than D<sub>1</sub>; remaining setae much shorter, L<sub>6</sub> only slightly longer than L<sub>5</sub>. Setae S<sub>1</sub> and S<sub>2</sub> on interscutal membrane. Peritreme extending beyond seta D<sub>1</sub>. Sternal shield with three pairs of setae; metasternal platelets slender. Ventrianal shield as long as wide, or slightly longer than wide, wider than genital shield. The elongate platelet near each anterolateral corner of the ventrianal shield is very often fused with the latter. Three pairs of preanal setae on ventrianal shield; a pair of transverse, conspicuous pores between and slightly before the posterior pair of preanals (the pores sometimes in a transverse line with the posterior preanals). Four pairs of setae on membrane surrounding ventrianal shield. Two pairs of metapodal platelets, the anterior pair very slender. Spermatheca as illustrated. Genu IV with a blunt-ended to subcapitate macroseta; tibia IV and basitarsus IV each with a pointed macroseta. Measurements in microns: idiosoma length 330, idiosoma width 230; lengths of setae: L<sub>1</sub> 22, L<sub>2</sub> 11, L<sub>3</sub> 12, L<sub>4</sub> 29, L<sub>5</sub> 10, L<sub>6</sub> 14, L<sub>7</sub> 12, L<sub>8</sub> 9, L<sub>9</sub> 65, M<sub>1</sub> 8, M<sub>2</sub> 35, D<sub>1</sub> 18, D<sub>2</sub> 8, D<sub>3</sub> 9, D<sub>4</sub> 10, D<sub>5</sub> 11, D<sub>6</sub> 6, S<sub>1</sub> 11, S<sub>2</sub> 9, VL<sub>1</sub> 34, macrosetae of leg IV: genu 37, tibia 30, basitarsus 45.

*Male.* Setae S<sub>1</sub> and S<sub>2</sub> on dorsal shield. Ventrianal shield with three pairs of preanal setae, a pair of pores being slightly anterior to, or in a transverse line with inner pair of posterior preanal setae. Spermatophoral process of chelicera hammer-shaped. Measurements in microns: idiosoma length 250, idiosoma width 150; lengths of setae: L<sub>1</sub> 18, L<sub>3</sub> 7, L<sub>4</sub> 19, L<sub>9</sub> 48, M<sub>2</sub> 19, D<sub>1</sub> 17, macrosetae of leg IV: genu 22, tibia 23, basitarsus 38.

*Types.* Holotype: ♀, Mombetsu, Prov. Hidaka, 23~24-VII-1966 (N. Kishi leg.), on *Cirsium kamtschaticum* Ledeb. Allotype: ♂, on *Cacalia hastata* L. var. *orientalis* (Kitam.) Ohwi. Paratypes: 4 ♀ ♀, data same as for holotype; 3 ♀ ♀, data same as for allotype; 2 ♀ ♀ & 4 ♂ ♂, on sasa bamboo, 1 ♀, on *Quercus dentata* Thunb., 1 ♀, on *Vitis coignetiae* Pulliat, 1 ♀, on *Onoclea sensibilis* L., other data same as for holotype.



**Remarks.** *Amblyseius (A.) ainu* n. sp. is closely allied to *A. (A.) oguroi* Ehara, 1964, and *A. (A.) okinawanus* Ehara, 1967, but is distinguished from these species by having  $L_4$  about twice as long as  $L_3$  and  $L_6$ , and by having  $L_9$  much shorter than distance between bases of  $L_9$ .



Figs. 21–27. *Amblyseius (Amblyseius) ainu* n. sp. 21, dorsum of idiosoma (♀). 22, posterior ventral surface (♀). 23, sternal shield (♀). 24, genu, tibia and basitarsus of leg IV (♀). 25, spermatheca. 26, ventrianal shield (♂). 27, spermatophoral process of ♂ chelicera.

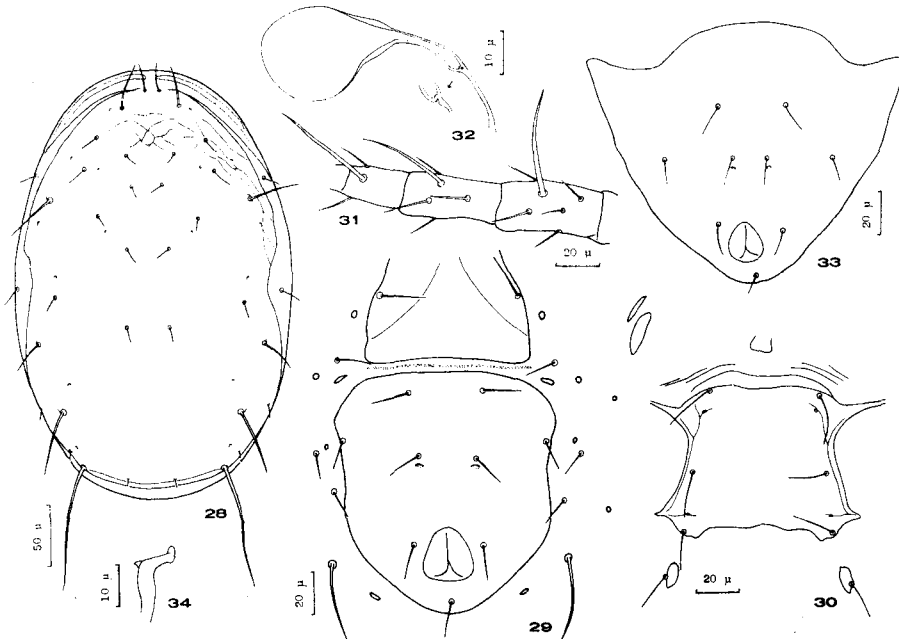
##### 5. *Amblyseius (Amblyseius) morii* n. sp.

(Jap. name: Sarobetsu-kaburidani)

(Figs. 28–34)

**Female.** Dorsal shield faintly reticulate, with at least eight pairs of pores; six pairs of dorsocentral setae. Setae on dorsal shield practically smooth except for setae  $M_2$  and  $L_9$  which are provided sparsely with minute barbs;  $L_6$  noticeably longer than  $L_5$ ; relative lengths:  $L_9 > M_2 > L_4 > L_1 > L_6 > D_1$ ;  $L_3 > L_2$ . Setae  $S_1$  and  $S_2$  on interscutal membrane. Peritreme extending forward to seta  $D_1$ . Sternal shield with three pairs of setae; metasternal platelets slender. Ventrianal shield slightly longer than, or about as long as wide, wider than genital shield, with lateral margins slightly concave. Three pairs of preanal setae on ventrianal shield; a pair of conspicuous transverse pores just behind the posterior preanal setae. Four pairs

of setae surrounding ventrianal shield. Two pairs of slender metapodal platelets, the anterior pair much smaller. Spermatheca as illustrated. Chelicera with fixed digit multidentate. Leg IV with three tapering macrosetae, that on genu weakly blunt-ended. Measurements in microns: idiosoma length 350, idiosoma width 230; lengths of setae:  $L_1$  32,  $L_2$  14,  $L_3$  18,  $L_4$  39,  $L_5$  13,  $L_6$  27,  $L_7$  11,  $L_8$  10,  $L_9$  89,  $M_1$  9,  $M_2$  49,  $D_1$  22,  $D_2$  10,  $D_3$  9,  $D_4$  12,  $D_5$  12,  $D_6$  8,  $S_1$  15,  $S_2$  16,  $VL_1$  34, macrosetae of leg IV: genu 39, tibia 35, basitarsus 40.



Figs. 28-34. *Amblyseius (Amblyseius) morii* n. sp. 28, dorsum of idiosoma (♀). 29, posterior ventral surface (♀). 30, sternal shield (♀). 31, genu, tibia and basitarsus of leg IV (♀). 32, spermatheca. 33, ventrianal shield (♂). 34, spermatophoral process of ♂ chelicera.

**Male.** Setae  $S_1$  and  $S_2$  on dorsal shield. Ventrianal shield with three pairs of preanal setae; a pair of pores just behind the innermost pair of preanals. Spermatophoral process of chelicera hammer-shaped. Measurements in microns: idiosoma length 270, idiosoma width 170; lengths of setae:  $L_1$  26,  $L_2$  10,  $L_3$  15,  $L_4$  32,  $L_5$  12,  $L_6$  20,  $L_7$  9,  $L_8$  8,  $L_9$  59,  $M_1$  9,  $M_2$  36,  $D_1$  19,  $D_2$  9,  $D_3$  9,  $D_4$  10,  $D_5$  10,  $D_6$  5,  $S_1$  14,  $S_2$  13,  $VL_1$  21, macrosetae of leg IV: genu 24, tibia 26, basitarsus 35.

**Types.** Holotype (♀) and allotype (♂): Toyotomi, Sarobetsu wasteland, 12~14-VII-1966 (H. Mori *et al.* leg.), on *Salix hultenii* Floderus var. *angustifolia* Kitamura. Paratypes: 7 ♀♀ & 2 ♂♂, on *Kalopanax pictus* (Thunb.), 1 ♀ & 1 ♂, on *Rhus ambigua* Lavallée, other data same as for holotype.

**Remarks.** Among a group of species bearing seta  $L_6$  noticeably longer than  $L_5$ , this new species is distinctive in having the ventrianal pores conspicuous, just behind the posterior pair of preanals. This mite is named in honor of Dr. Hans Mori who have generously furnished many specimens of phytoseiids for this study.

## 6. *Amblyseius (Amblyseius) tsugawai* Ehara

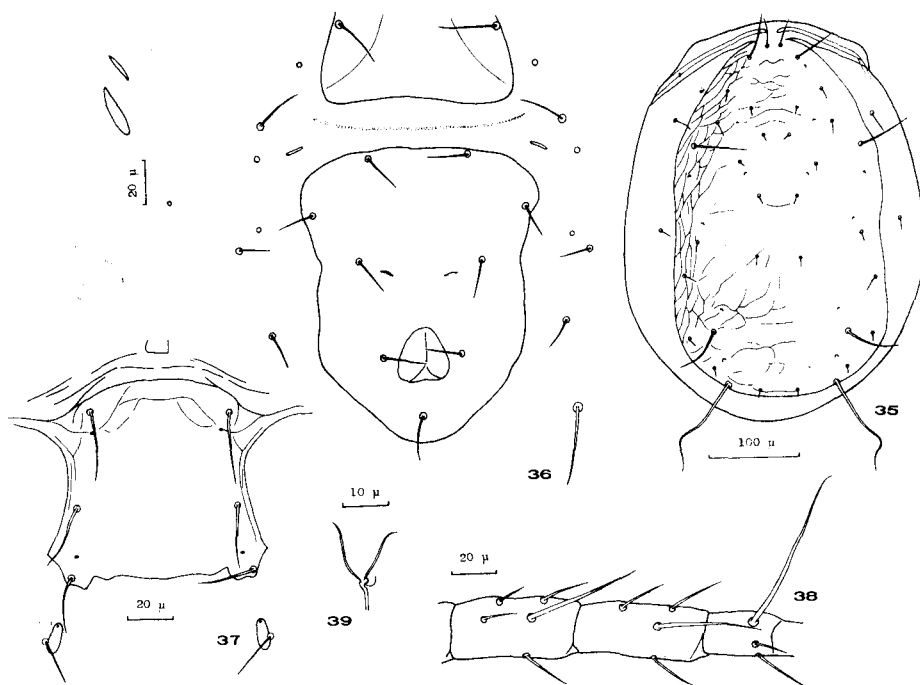
(Figs. 35-39)

*Amblyseius tsugawai* Ehara, 1959, p. 290, Figs. 12, 13; Ehara, 1964, p. 386, Figs. 24-27.

*Typhlodromus (Amblyseius) tsugawai*, Chant, 1959, p. 92.

*Amblyseius (Amblyseius) tsugawai*, Ehara, 1966, p. 23.

This mite was previously known only from Honshu, and it is new to Hokkaido. Measurements for female (in microns): idiosoma length 410, idiosoma width 280; lengths of setae:  $L_1$  35,  $L_4$  49,  $L_9$  116,  $M_2$  50,  $D_1$  26,  $VL_1$  44, macrosetae of leg IV: genu 45, tibia 42, basitarsus 67. The measurements for the male were given in a previous paper (Ehara, 1964).



Figs. 35-39. *Amblyseius (Amblyseius) tsugawai* Ehara. 35, dorsum of idiosoma (♀). 36, posterior ventral surface (♀). 37, sternal shield (♀). 38, genu, tibia and basitarsus of leg IV (♀). 39, spermatheca.

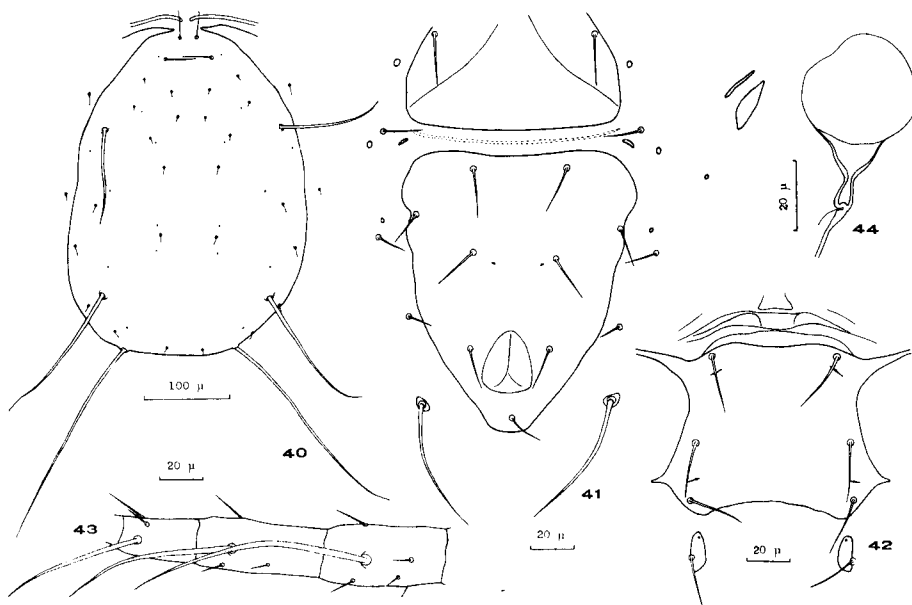
*Specimens from Hokkaido.* One ♀, Sapporo, 31-VII-1966 (N. Kishi leg.), on *Magnolia kobus* DC. var. *borealis* Sarg.; 2 ♀♀, on *Filipendula kamtschatica* (Pall.) Maxim.; 2 ♀♀ & 2 ♂♂, on *Salix hultenii* Floderus var. *angustifolia* Kimura, 6 ♀♀ & 1 ♂, on *Cirsium kamtschaticum* Ledeb., Toyotomi, Sarobetsu wasteland, 12~14-VII-1966 (H. Mori *et al.* leg.).

7. *Amblyseius (Amblyseius) firmus* n. sp.

(Jap. name: Oni-kaburidani)

(Figs. 40-44)

*Female.* Body heavily sclerotized. Dorsal shield nearly smooth, with many minute pores which are partly shown in Fig. 40; six pairs of dorsocentral setae. Setae on dorsal shield smooth except for setae  $L_9$  and  $M_2$  which are weakly pectinate;  $L_4$ ,  $L_9$  and  $M_2$  very long, whip-like;  $D_1$  and  $L_1$  smaller, subequal in length; remaining setae minute. Setae  $S_1$  and  $S_2$  on interscutal membrane. Peritremes extending between setae  $D_1$ . Sternal shield with three pairs of setae; metasternal platelets slender. Ventrianal shield triangular, longer than wide, slightly wider than genital shield; three pairs of preanal setae; a pair of minute pores between and slightly behind the posterior pair of preanals. Four pairs of setae surround-



Figs. 40-44. *Amblyseius (Amblyseius) firmus* n. sp. 40, dorsum of idiosoma (♀). 41, posterior ventral surface (♀). 42, sternal shield (♀). 43, genu, tibia and basitarsus of leg IV (♀). 44, spermatheca.

ing ventrianal shield. Two pairs of metapodal platelets, the anterior pair very slender, the posterior pair much wider, approximately triangular. Spermatheca with cervix constricted medially. Chelicera with fixed digit multidentate. Leg IV with a whip-like macroseta on genu, tibia and basitarsus. Measurements in microns: idiosoma length 370, idiosoma width 300; lengths of setae:  $L_1$  31,  $L_2$  6,  $L_3$  6,  $L_4$  103,  $L_5$  9,  $L_6$  13,  $L_7$  11,  $L_8$  10,  $L_9$  236,  $M_1$  6,  $M_2$  157,  $D_1$  29,  $D_2$  6,  $D_3$  6,  $D_4$  7,  $D_5$  9,  $D_6$  6,  $S_1$  11,  $S_2$  9,  $VL_1$  58, macrosetae of leg IV: genu 101, tibia 75, basitarsus 63.

*Male.* Not known.

*Types.* Holotype: ♀, Mombetsu, Prov. Hidaka, 23~24-VII-1966 (N. Kishi leg.), on *Magnolia kobus* DC. var. *borealis* Sarg. Paratype: 1 ♀, on *Osmunda cinnamomea* L., other data same as for holotype.

*Remarks.* *Amblyseius* (*A.*) *firmus* n. sp. most closely resembles *A.* (*A.*) *saurus* De Leon, 1962, but differs from the latter in having the cervix of the spermatheca constricted medially, and in the position and size of the ventrianal pores. This new species is also similar to *A.* (*A.*) *krantzi* Chant, 1959, but is easily separable from it by the ventrianal shield, particularly by the position of the posterior preanal setae and of the pores.

#### 8. *Amblyseius* (*Amblyseius*) *ezoensis* n. sp.

(Jap. name: Ezo-kaburidani)

(Figs. 45-49)

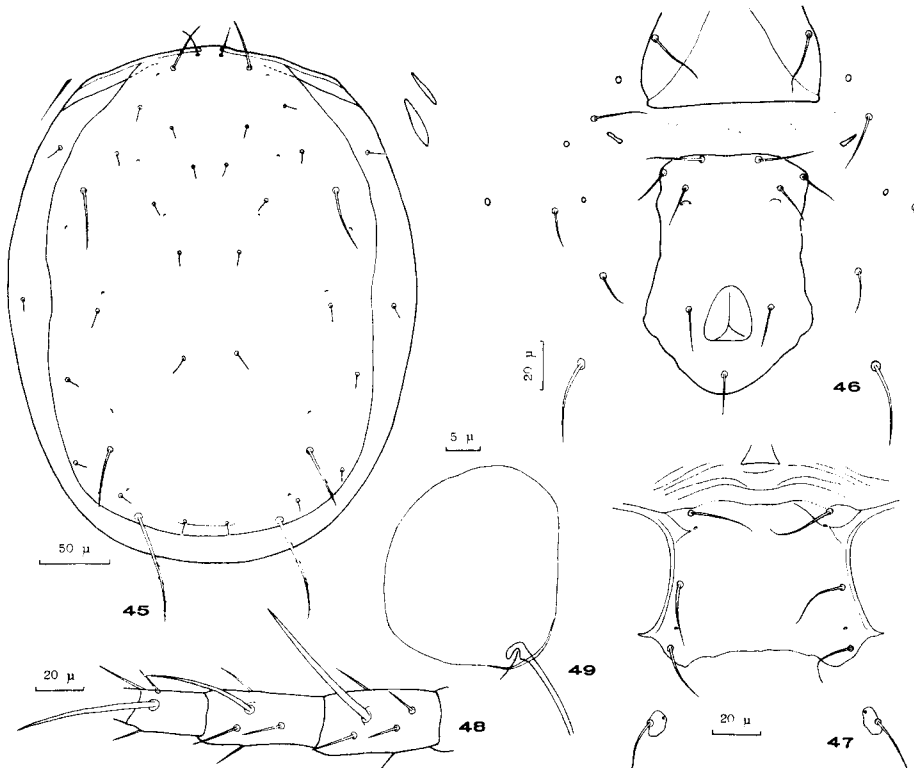
*Female.* Dorsal shield nearly smooth, with at least seven pairs of pores; six pairs of dorsocentral setae. Setae on dorsal shield:  $L_9$  and  $M_2$  stout, with minute barbs sparsely,  $L_9$  less than twice as long as  $M_2$ ;  $L_1$  and  $L_4$  stout, practically smooth,  $L_4$  about as long as  $M_2$ ; remaining setae short to minute. Setae  $S_1$  and  $S_2$  on interscutal membrane. Peritreme extending to seta  $D_1$ . Sternal shield with three pairs of setae; metasternal platelets as illustrated. Ventrianal shield slender, approximately vase-shaped, widest at level of anus, nearly as wide as genital shield; three pairs of preanal setae and a pair of pores on anterior one-third of preanal region, the pores crescent-shaped, just caudad from the posteriormost preanals. Four pairs of setae on membrane surrounding ventrianal shield. Two pairs of slender metapodal platelets. Spermatheca as figured. Chelicera with fixed digit multidentate. Leg IV with three tapering macrosetae. Measurements in microns: idiosoma length 360, idiosoma width 280; lengths of setae:  $L_1$  30,  $L_2$  10,  $L_3$  9,  $L_4$  40,  $L_5$  13,  $L_6$  10,  $L_7$  9,  $L_8$  9,  $L_9$  72,  $M_1$  10,  $M_2$  40,  $D_1$  20,  $D_2$  9,  $D_3$  9,  $D_4$  10,  $D_5$  14,  $D_6$  8,  $S_1$  12,  $S_2$  9,  $VL_1$  30, macrosetae of leg IV: genu 57, tibia 42, basitarsus 56.

*Male.* Not known.

*Types.* Holotype: ♀, Mt. Moiwa, Sapporo, 25-V-1966 (N. Kishi leg.), on *Heracleum dulce* Fisch. Paratype: 1 ♀, data same as for holotype.

*Remarks.* *Amblyseius* (*A.*) *ezoensis* n. sp. resembles *A.* (*A.*) *terminalis* Chant and Baker, 1965, and *A.* (*A.*) *estradaei* Chant and Baker, 1965, both of which are known from Central America. But, this new species is distinguished from these

species by its characteristic ventrianal shield, and by having three macrosetae on leg IV.



Figs. 45–49. *Amblyseius (Amblyseius) ezoensis* n. sp. 45, dorsum of idiosoma (♀). 46, posterior ventral surface (♀). 47, sternal shield (♀). 48, genu, tibia and basitarsus of leg IV (♀). 49, spermatheca.

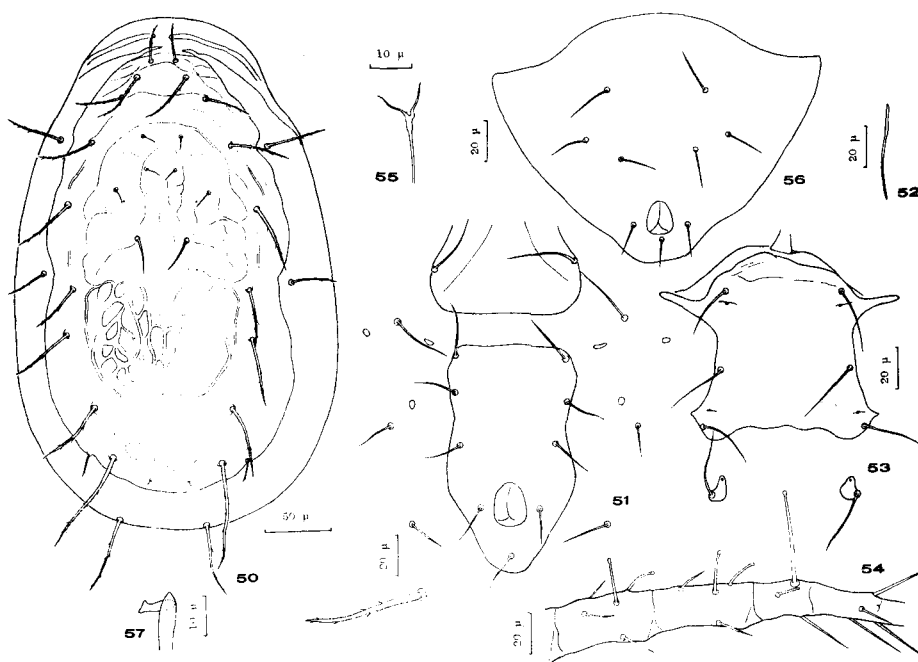
#### 9. *Amblyseius (Kampimodromus) maritimus* n. sp.

(Jap. name: Hamanasu-kaburidani)

(Figs. 50–57)

*Female.* Dorsal shield rugose, with five pairs of dorsocentral setae (seta  $D_5$  absent). Dorsal setae barbed except setae  $D_2$  to  $D_6$  and  $M_1$  which are nude;  $D_2$ ,  $D_3$ , and  $D_6$  very small, remaining setae more or less stout;  $L_8$  approximately in a transverse line with  $L_9$ . Peritremes extending beyond setae  $D_1$ . Sternal shield with three pairs of setae; metasternal platelets as figured. Ventrianal shield much longer than wide, slightly narrower than genital shield; three pairs of preanal setae

nearly in a longitudinal line; no pores. Four pairs of setae surrounding ventrianal shield, seta  $VL_1$  stout, barbed. A pair of reduced, filamentous metapodal platelets. Spermatheca as illustrated. Fixed digit of chelicera with a few teeth. Genu IV, tibia IV, and basitarsus IV each with a capitate macroseta; distitarsus IV with a similar, weak macroseta; genu IV, tibia IV, and basitarsus IV each with one or more capitate to blunt setae. Measurements in microns: idiosoma length 400, idiosoma width 280; lengths of setae:  $L_1$  42,  $L_2$  39,  $L_3$  47,  $L_4$  52,  $L_5$  43,  $L_6$  53,  $L_8$  25,  $L_9$  79,  $M_1$  17,  $M_2$  57,  $D_1$  29,  $D_2$  12,  $D_3$  12,  $D_4$  29,  $D_6$  5,  $S_1$  47,  $S_2$  35,  $VL_1$  56, macrosetae of leg IV: genu 20, tibia 18, basitarsus 43, distitarsus 27.



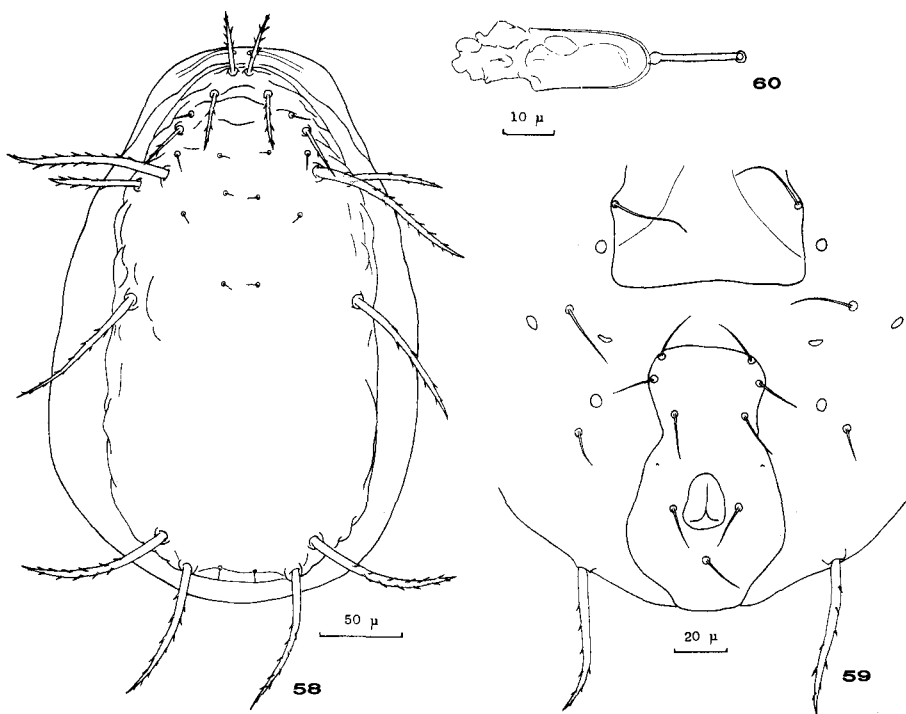
Figs. 50–57. *Amblyseius (Kampimodromus) maritimus* n. sp. 50, dorsum of idiosoma (♀). 51, posterior ventral surface (♀). 52, left metapodal platelet (♀). 53, sternal shield (♀). 54, genu, tibia and tarsus of leg IV (♀). 55, spermatheca. 56, ventrianal shield (♂). 57, spermatophoral process of ♂ chelicera.

**Male.** Setae  $S_1$  and  $S_2$  on dorsal shield. Ventrianal shield with three pairs of preanal setae. Spermatophoral process of chelicera as illustrated. Genu IV, tibia IV, and basitarsus IV each with two capitate setae including macroseta; distitarsus IV with a blunt macroseta. Measurements in microns: idiosoma length 280, idiosoma width 190; lengths of setae:  $L_1$  34,  $L_2$  30,  $L_3$  35,  $L_4$  40,  $L_5$  29,  $L_6$  36,  $L_8$  13,  $L_9$  58,  $M_1$  12,  $M_2$  40,  $D_1$  24,  $D_2$  9,  $D_3$  10,  $D_4$  21,  $D_6$  4,  $S_1$  38,  $S_2$  27,  $VL_1$  32, macrosetae of leg IV: genu 18, tibia 16, basitarsus 33, distitarsus 23.

*Types.* Holotype (♀) and allotype (♂): Hamakoshimizu, Prov. Abashiri, 29-VIII-1966 (H. Tamura leg.), on *Rosa rugosa* Thunb. Paratypes: 4 ♀♀ & 4 ♂♂, data same as for holotype; 1 ♀, 21-VI-1966 (T. Matsumura leg.), other data same as for holotype; 16 ♀♀ & 2 ♂♂, 14-IX-1966 (H. Fukuda leg.), other data same as for holotype. These type specimens were collected on leaves and galls of this plant. These galls were produced by a cynipid wasp *Liebelia* (*Nipporhodites*) *fukudae* Shinji.

In addition to these types a female specimen taken from Mombetsu (Prov. Hidaka), though in poor condition, is now referred to the present new species. Other data of this specimen are: July 23-24, 1966 (N. Kishi leg.), on *Athyrium brevifrons* Nakai.

*Remarks.* This new species can be separated from *Amblyseius* (*Kampimodromus*) *aberrans* (Oudemans, 1930a), *A. (K.) irregularis* (Evans, 1953), and *A. (K.) judaicus* Swirski and Amitai, 1961, by the absence of seta D<sub>5</sub>, and by other many characters.



Figs. 58-60. *Phytoseius* (*Phytoseius*) *nipponicus* Ehara. 58, dorsum of idiosoma (♀). 59, posterior ventral surface (♀). 60, spermatheca.

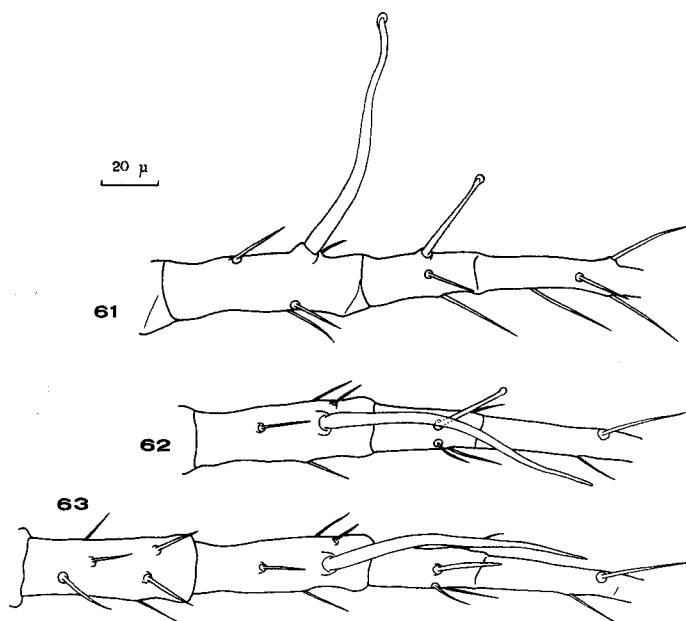


10. *Phytoseius (Phytoseius) nipponicus* Ehara

(Figs. 58-63)

*Phytoseius (Dubininellus) nipponicus* Ehara, 1962, p. 55, Figs. 7-11; Denmark, 1966, p. 90, Fig. 38.*Phytoseius (Phytoseius) nipponicus*, Ehara, 1966, p. 26.

*Phytoseius nipponicus* has been known only from Honshu, and it is new to Hokkaido. The macrosetae of leg IV of the female show much intraspecific variation in tip feature. Both sexes of the type specimens (type locality: Den-en-chôfu, Tokyo) have two capitate macrosetae on leg IV. These macrosetae, however, are tapering (more or less blunt-ended) in many female specimens from Hokkaido while they are capitate in females from Mombetsu, Prov. Hidaka. That the specimens of these two groups belong to the same species is acceptable from the following facts: 1) Intermediate female specimens regarding to macrosetae on leg IV were occasionally found; 2) A female with two capitate macrosetae on leg



Figs. 61-63. *Phytoseius (Phytoseius) nipponicus* Ehara. Leg IV (♀), showing variation of macrosetae.

IV occurred within a population of specimens having tapering macrosetae. On the other hand, leg IV of the male is provided constantly with two capitate macrosetae in all populations herein studied. At any rate, it is concluded that for recognition of phytoseiid species, at least those of *Phytoseius*, the shape of macroseta tips should not be emphasized too much.

Further, the lengths of some setae of this species are considerably variable among different specimens. The length ranges of main setae of Hokkaido specimens (in microns) are: *female*:  $L_5$  81–113,  $L_6$  80–99,  $L_7$  64–87,  $M_2$  65–90, macroseta of tibia IV 73–94, macroseta of basitarsus IV 21–32; *male*:  $L_5$  54–62,  $L_6$  48–58,  $L_7$  36–48,  $M_2$  36–45, macroseta of tibia IV 58–91, macroseta of basitarsus IV 21–26.

*Specimens from Hokkaido.* Many specimens ( $\varnothing \varnothing$  &  $\hat{\sigma} \hat{\sigma}$ ) collected in Sapporo and its vicinity by Mr. N. Kishi are from the following plants: *Filipendula kamtschatica* (Pall.) Maxim., *Helianthus tuberosus* L., *Morus bombycis* Koidz., *Sambucus sieboldiana* Blume var. *miquelii* (Nakai) Hara, *Urtica platyphylla* Wedd., and *Vitis coignetiae* Pulliat.

Materials from other localities: one female collected from mulberry at Toyotomi, Sarobetsu wasteland, by Dr. H. Mori *et al.*; a few specimens ( $\varnothing \varnothing$  &  $\hat{\sigma} \hat{\sigma}$ ) collected at Mombetsu, Prov. Hidaka, by Mr. N. Kishi from *Aralia cordata* Thunb., *Cirsium kamtschaticum* Ledeb., and *Quercus dentata* Thunb.; two females taken from *Rosa rugosa* Thunb. (leaves or galls<sup>1)</sup>) at Hamakoshimizu, Prov. Abashiri, by Mr. T. Matsumura and Mr. H. Tamura.

#### 11. *Phytoseius (Phytoseius) kishii* n. sp.

(Jap. name: Hokkai-kaburidani)

(Figs. 64–67)

*Female.* Dorsal shield rugose, with five pairs of dorsocentral setae (seta  $D_5$  absent). Setae on dorsal shield anchored on tubercles;  $L_1$ ,  $L_3$ ,  $L_5$ ,  $L_6$ ,  $L_7$ ,  $M_2$ ,  $D_1$ , and  $S_1$  stout, strongly serrate;  $L_1$  and  $S_1$  approximately equal-sized, larger than  $D_1$  and  $L_3$  which are about equal-sized;  $L_7$  close to  $M_2$ ;  $L_2$  and  $L_4$  practically smooth;  $D_2$  to  $D_4$ ,  $D_6$ , and  $M_1$  minute. Peritremes not extending between setae  $D_1$ . Sternal shield with three pairs of setae; metasternal setae on small platelets. Ventrianal shield much longer than wide, and much narrower than genital shield; the lateral margins strongly concave; three pairs of preanal setae. Three pairs of setae surrounding ventrianal shield, seta  $VL_1$  stout, strongly serrate. A pair of slender metapodal platelets. Spermatheca as illustrated. Fixed digit of chelicera with a few teeth. Tibia IV with a spatulate macroseta, the tip with a very narrow hyaline envelope; genu IV and basitarsus IV each with a more or less blunt-ended macroseta, distitarsus IV with a similar, weak macroseta. Measurements in microns: idiosoma length 350, idiosoma width 240; lengths of setae:  $L_1$  42,  $L_2$  18,  $L_3$  32,  $L_4$  18,  $L_5$  97,  $L_6$  66,  $L_7$  68,  $M_1$  5,  $M_2$  74,  $D_1$  31,  $D_2$  5,  $D_3$  4,  $D_4$  5,  $D_6$  6,  $S_1$  43,  $VL_1$  44, macrosetae of leg IV: genu 17, tibia 42, basitarsus 25, distitarsus 26.

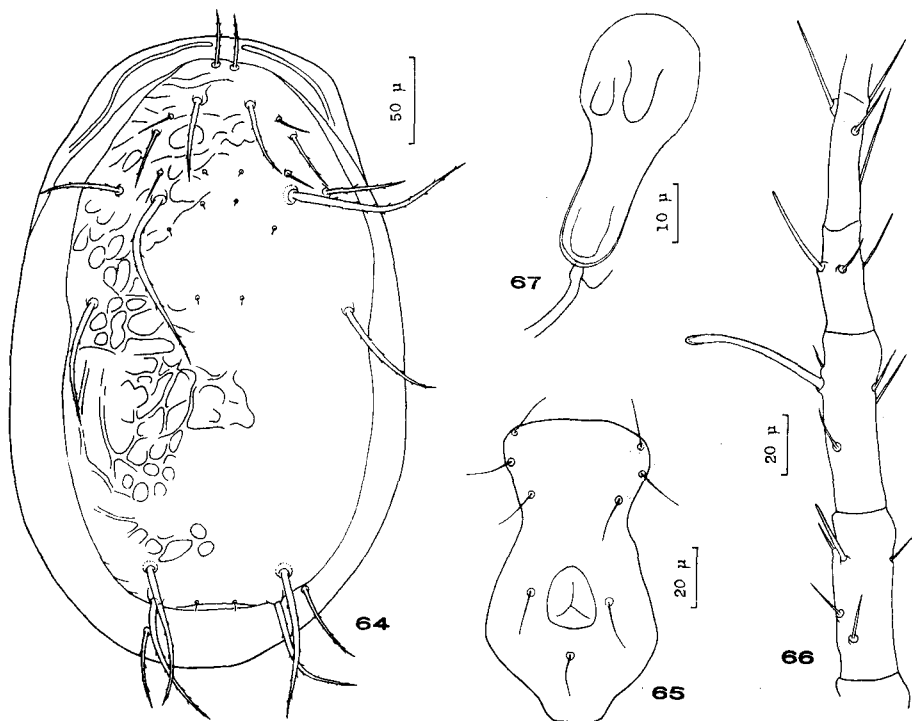
*Male.* Not known.

*Types.* Holotype: ♀, Sapporo, 5-VI-1966 (N. Kishi leg.), on *Vitis coignetiae* Pulliat. Paratypes: 5 ♀♀, data same as for holotype.

*Remarks.* *Phytoseius (P.) kishii* n. sp. is closely allied to *P. (P.) corniger*

1) Produced by a cynipid wasp *Liebelia (Nipporhodites) fukudae* Shinji.

Wainstein, 1959, but is different from the latter in the relative lengths of setae  $L_1$  and  $S_1$ , and of setae  $L_2$  and  $L_4$ . *P. (P.) kishii* n. sp. is also similar to *P. (P.) horridus* Ribaga, 1902, but is distinctive from it in the relative lengths of the segments and macrosetae of leg IV and in the shape of the spermatheca (Chant and Athias-Henriot, 1960; Denmark, 1966). This new mite is named in honor of Mr. Nobuo Kishi who kindly submitted many specimens of mites for this study.



Figs. 64–67. *Phytoseius (Phytoseius) kishii* n. sp. 64, dorsum of idiosoma (♀). 65, ventrianal shield (♀). 66, genu, tibia and tarsus of leg IV (♀). 67, spermatheca.

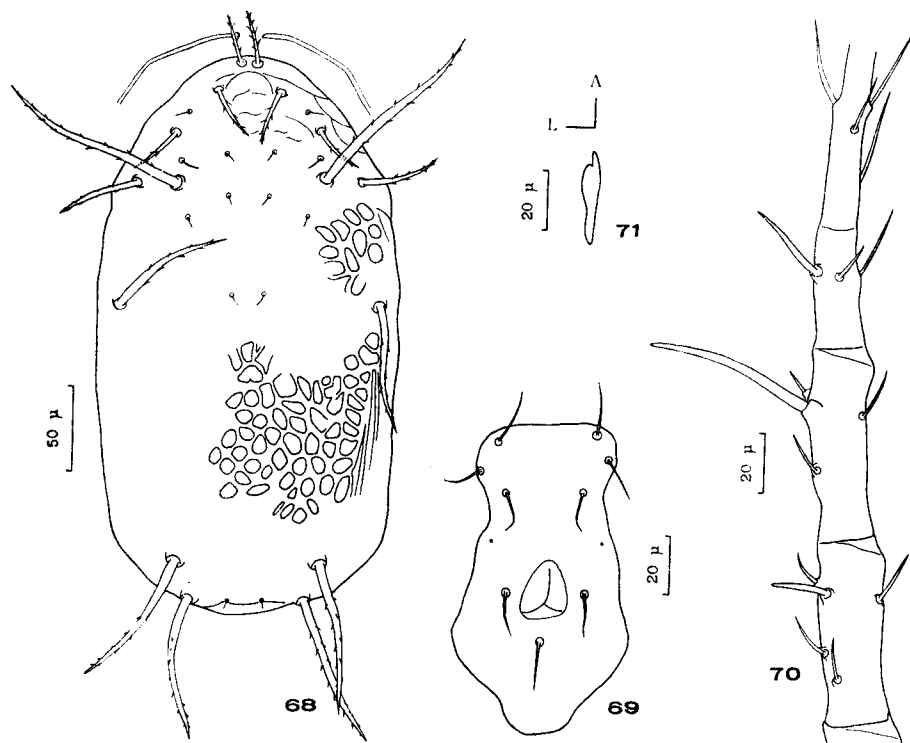
## 12. *Phytoseius (Phytoseius) campestris* n. sp.

(Jap. name: Sôya-kaburidani)

(Figs. 68–71)

*Female.* Dorsal shield rugose, with five pairs of dorsocentral setae (seta  $D_5$  absent). Setae on dorsal shield arising from tubercles;  $L_1$ ,  $L_3$ ,  $L_5$ ,  $L_6$ ,  $L_7$ ,  $M_2$ ,  $D_1$ , and  $S_1$  stout, strongly serrate,  $S_1$  much longer than  $L_1$ ,  $L_3$ , and  $D_1$ ;  $L_7$  close to  $M_2$ ;  $L_2$  and  $L_4$  practically smooth;  $D_2$  to  $D_4$ ,  $D_6$ , and  $M_1$  minute. Peritreme extending forward to seta  $D_1$ . Sternal shield with three pairs of setae; metasternal setae on

small platelets. Ventrianal shield slender, narrower than genital shield, concave laterally, with three pairs of preanal setae and a pair of minute pores. Three pairs of setae on membrane surrounding ventrianal shield, seta  $VL_1$  stout, strongly serrate. A pair of slender metapodal platelets. Cervix of spermatheca U-shaped, about  $11\mu$  wide; atrium and major duct, combined lengths, at least  $18\mu$ . Genu IV, tibia IV, and basitarsus IV each with a blunt-ended macroseta; distitarsus IV with



Figs. 68-71. *Phytoseius (Phytoseius) campestris* n. sp. 68, dorsum of idiosoma (♀). 69, ventrianal shield (♀). 70, genu, tibia and tarsus of leg IV (♀). 71, metapodal platelet (♀) (A, anterior direction; L, lateral direction).

a similar macroseta. Measurements in microns: idiosoma length 400, idiosoma width 240; lengths of setae:  $L_1$  31,  $L_2$  12,  $L_3$  32,  $L_4$  14,  $L_5$  107,  $L_6$  70,  $L_7$  84,  $M_1$  8,  $M_2$  82,  $D_1$  29,  $D_2$  7,  $D_3$  7,  $D_4$  8,  $D_5$  6,  $S_1$  46,  $VL_1$  58, macrosetae of leg IV: genu 19, tibia 56, basitarsus 29, distitarsus 29.

*Male.* Not known.

*Type.* Holotype: ♀, Toyotomi, Sarobetsu wasteland, 12~14-VII-1966 (H. Mori *et al.* leg.), on *Kalopanax pictus* (Thunb.).

*Remarks.* *Phytoseius (P.) campestris* n. sp. is closely allied to *P. (P.) corniger*

Wainstein, 1959, and *P. (P.) horridus* Ribaga, 1902, but is distinct from these species in the relative lengths of setae  $S_1$ ,  $L_1$ ,  $L_3$ , and  $D_1$ .

**Key to species of Phytoseiidae found in Hokkaido (females)**

1. Setae  $S_1$  and  $S_2$  on interscutal membrane..... 2
  - Seta  $S_1$  on dorsal shield, seta  $S_2$  absent..... 16
2. Proscutum with 6 pairs of lateral setae..... 3
  - Proscutum with 4 pairs of lateral setae..... 4
3. Seta  $M_2$  longer than  $L_8$ ..... *Typhlodromus (Anthoseius) vulgaris* Eh.
  - Seta  $M_2$  subequal in length to  $L_8$ ..... *Typhlodromus (Anthoseius) borealis* Eh.
4. Seta  $M_2$  more or less in a transverse line with  $L_7$ ..... 5
  - Seta  $M_2$  not in a transverse line with any lateral setae.....
    - ..... *Amblyseius (Kampimodromus) maritimus* Eh.
5. Setae  $D_2$  to  $D_5$  shorter than distances between their bases..... 6
  - Setae  $D_2$  to  $D_5$  longer than distances between their bases.....
    - ..... *Amblyseius (Amblyseius) longispinosus* (Evans)
6. Three pairs of preanal setae not in a transverse line; peritreme long, extending more or less near seta  $D_1$ ..... 7
  - Three pairs of preanal setae more or less in a transverse line; peritreme short, reaching only to coxa II. *Amblyseius (Amblyseius) finlandicus* (Oudemans)
7. None of the prolateral setae three times as long as  $D_2$  and  $D_3$ ..... 8
  - One or more of the prolateral setae at least three times as long as  $D_2$  and  $D_3$ .
    - ..... 11
8. Seta  $L_4$  less than twice as long as  $L_3$  and  $L_6$ ..... 9
  - Seta  $L_4$  about twice as long as  $L_3$  and  $L_6$ .....
    - ..... *Amblyseius (Amblyseius) ainu* Eh.
9. Seta  $M_2$  shorter than distance between its base and that of  $L_9$ ..... 10
  - Seta  $M_2$  longer than distance between its base and that of  $L_9$ .....
    - ..... *Amblyseius (Amblyseius) oguroi* Eh.
10. Seta  $L_7$  approximately half as long as  $M_2$ .....
  - ..... *Amblyseius (Amblyseius) haimatus* Eh.
  - Seta  $L_7$  slightly shorter than  $M_2$ ..... *Amblyseius (Amblyseius) paraki* Eh.
11. Seta  $L_6$  similar in length to  $L_5$ ..... 12
  - Seta  $L_6$  noticeably longer than  $L_5$ ..... *Amblyseius (Amblyseius) morii* Eh.
12. Ventrianal shield with the posteriormost pair of preanal setae and pores on anterior one-third of preanal region.... *Amblyseius (Amblyseius) ezoensis* Eh.
  - Ventrianal shield with the posteriormost preanal setae and pores not on anterior one-third of preanal region..... 13
13. Seta  $L_9$  greatly longer than  $M_2$ ..... 14
  - Seta  $L_9$  only slightly longer than  $M_2$ .....

- ..... *Amblyseius (Amblyseius) rademacheri* Dosse<sup>1)</sup>
14. Macroseta of basitarsus IV shorter than that of genu IV..... 15  
 - Macroseta of basitarsus IV longer than that of genu IV.....  
 ..... *Amblyseius (Amblyseius) tsugawai* Eh.
15. Seta L<sub>1</sub> longer than D<sub>1</sub>; L<sub>9</sub> approximately twice as long as M<sub>2</sub>.....  
 ..... *Amblyseius (Amblyseius) orientalis* Eh.<sup>2)</sup>  
 - Seta L<sub>1</sub> approximately as long as D<sub>1</sub>; L<sub>9</sub> about 1.5 times as long as M<sub>2</sub>. ....  
 ..... *Amblyseius (Amblyseius) firmus* Eh.
16. Ventrianal shield with three pairs of preanal setae..... 17  
 - Ventrianal shield with one pair of preanal setae. ....  
 ..... *Phytoseius (Phytoseius) blakistoni* Eh.
17. Genu IV with a macroseta ..... 18  
 - Genu IV without macroseta ..... *Phytoseius (Phytoseius) nipponicus* Eh.
18. Setae S<sub>1</sub> and L<sub>1</sub> subequal in length. .... *Phytoseius (Phytoseius) kishii* Eh.  
 - Seta S<sub>1</sub> noticeably longer than L<sub>1</sub>.... *Phytoseius (Phytoseius) campestris* Eh.

### Summary

1. This paper deals with descriptions and records of twelve species belonging to the family Phytoseiidae from Hokkaido.

2. The following ten species are described as new: *Typhlodromus (Anthoseius) borealis*, *Amblyseius (Amblyseius) haimatus*, *A. (A.) paraki*, *A. (A.) ainu*, *A. (A.) morii*, *A. (A.) firmus*, *A. (A.) ezoensis*, *Amblyseius (Kampimodromus) maritimus*, *Phytoseius (Phytoseius) kishii*, *P. (P.) campestris*.

3. *Amblyseius (Amblyseius) tsugawai* Ehara, and *Phytoseius (Phytoseius) nipponicus* Ehara are first recorded from Hokkaido.

4. The macrosetae of female leg IV of *P. (P.) nipponicus* show much intraspecific variation in tip feature.

5. A key to the species of phytoseiids of Hokkaido is given.

### References

- Berlese, A. 1915. Acari nuovi. Redia **10**: 113-147.  
 Chant, D.A. 1959. Phytoseiid mites (Acarina: Phytoseiidae). Part I. Bionomics of seven species in southeastern England. Part II. A taxonomic review of the family Phytoseiidae, with descriptions of 38 new species. Canad. Ent. **91**, Suppl. **12**: 1-166.  
 Chant, D.A., and C. Athias-Henriot 1960. The genus *Phytoseius* Ribaga, 1902 (Acarina:

1) In a previous paper (Ehara, 1959) the length of female seta L<sub>9</sub> of *A. rademacheri* was erroneously described. The length measurements of main dorsal setae of female *rademacheri* are: L<sub>4</sub> 62μ, L<sub>9</sub> 98 μ, and M<sub>2</sub> 87 μ.

2) Length measurements of main dorsal setae of *A. orientalis* (female): L<sub>4</sub> 92μ, L<sub>9</sub> 230 μ, M<sub>2</sub> 115μ.

- Phytoseiidae). Entomophaga **5**: 213-228.
- Chant, D.A., and E.W. Baker 1965. The Phytoseiidae (Acarina) of Central America. Mem. Ent. Soc. Canada **41**: 1-56.
- De Leon, D. 1962. Twenty-three new phytoseiids, mostly from southeastern United States (Acarina: Phytoseiidae). Fla. Ent. **45**: 11-27.
- Denmark, H.A. 1966. Revision of the genus *Phytoseius* Ribaga, 1904 (Acarina: Phytoseiidae). Fla. Dept. Agr. Bull. **6**: 1-105.
- Dosse, G. 1957. Morphologie und Biologie von *Typhlodromus zwölfperi* n. sp. (Acar., Phytoseiidae). Z. ang. Ent. **41**: 301-311.
- Ehara, S. 1959. Some predatory mites of the genera *Typhlodromus* and *Amblyseius* from Japan (Phytoseiidae). Acarologia **1**: 285-295.
- 1962. Notes on some predatory mites (Phytoseiidae and Stigmaeidae). Jap. J. Appl. Ent. Zool. **6**: 53-60.
- 1964. Some mites of the families Phytoseiidae and Blattisociidae from Japan (Acarina: Mesostigmata). Jour. Fac. Sci. Hokkaido Univ. Ser. 6 Zool. **15**: 378-394.
- 1966. A tentative catalogue of predatory mites of Phytoseiidae known from Asia, with descriptions of five new species from Japan. Mushi **39**: 9-30.
- 1967. Phytoseiid mites from Okinawa Island (Acarina: Mesostigmata). Mushi **40**: 67-82.
- Evans, G.O. 1953. On some mites of the genus *Typhlodromus* Scheuten, 1857, from S.E. Asia. Ann. Mag. Nat. Hist. (12) **6**: 449-467.
- Garman, P. 1948. Mite species from apple trees in Connecticut. Bull. Conn. Agr. Exp. Sta. **520**: 1-27.
- Hughes, A.M. 1948. The mites associated with stored food products. 168 pp. Minist. Agr. Fish., London.
- Karg, W. 1962. Zur Systematik und postembryonalen Entwicklung der Gamasiden (Acarina, Parasitiformes) landwirtschaftlich genützter Böden. Mitt. Zool. Mus. Berlin **38**: 23-119.
- Oudemans, A.C. 1930a. Acarologische Aanteekeningen CI. Ent. Ber. **8**: 48-53.
- 1930b. Acarologische Aanteekeningen CII. Ent. Ber. **8**: 69-74.
- Ribaga, C. 1902. Gamasidi planticoli. Riv. Patol. Veg. **10**: 175-178.
- Schuster, R.O., and R.H. González 1963. Redescription and notes on *Amblyseius cucumeris* (Oudemans) (Acarina: Phytoseiidae). Acarologia **5**: 185-188.
- Swirski, E., and S. Amitai 1961. Some phytoseiid mites (Acarina: Phytoseiidae) of Israel, with a description of two new species. Israel J. Agr. Res. **11**: 193-202.
- Wainstein, B.A. 1958. Novye vidy *Typhlodromus* (Parasitiformes, Phytoseiidae) iz Gruzii. Soobsh. Akad. Nauk Gruz. S.S.R. **21**: 201-207.
- 1959. A new subgenus and species of the genus *Phytoseius* Ribaga, 1902 (Phytoseiidae, Parasitiformes). Zool. Zh. **38**: 1361-1365 (in Russian with English summary).